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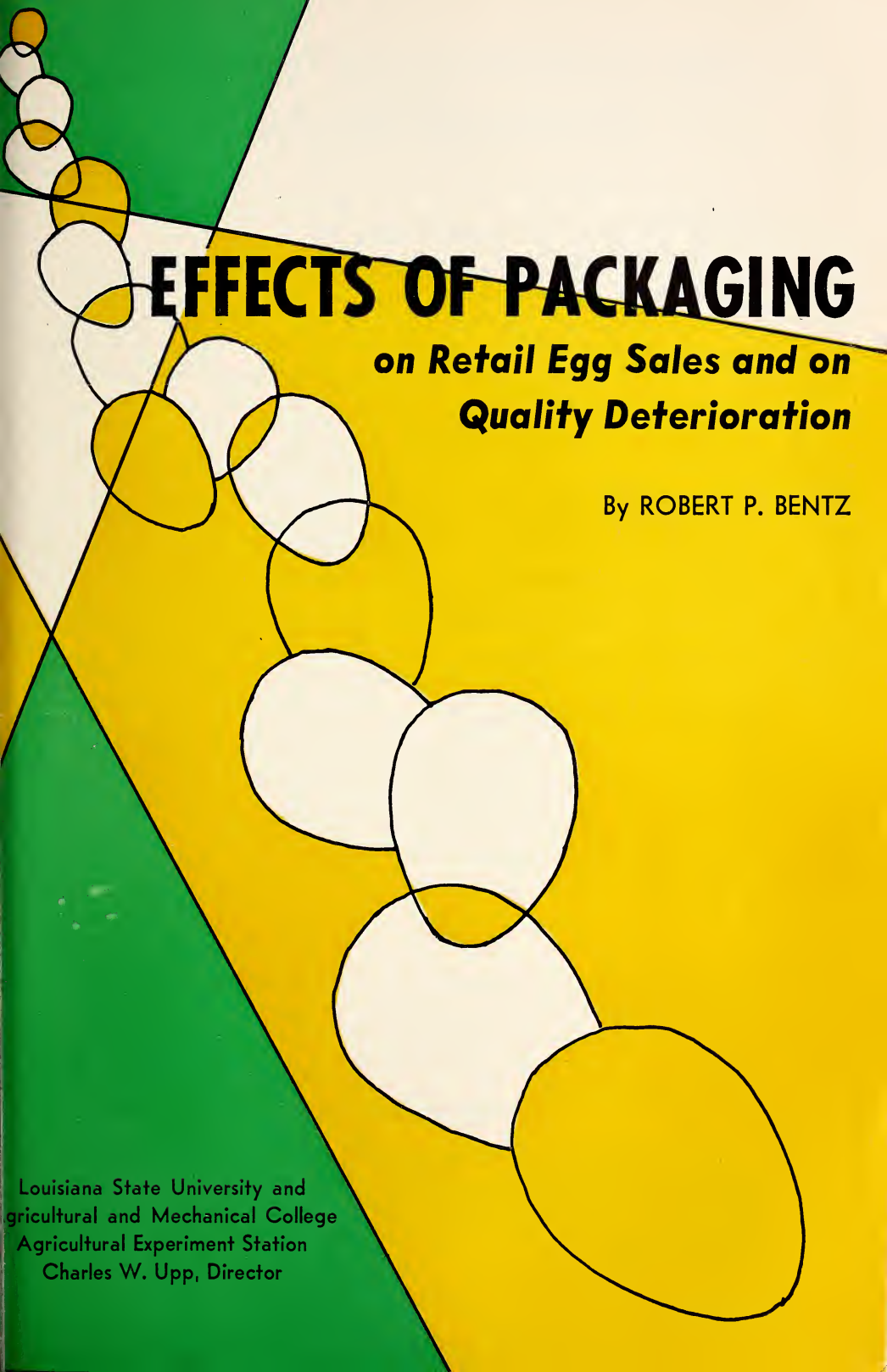

EFFECTS OF PACKAGING

on Retail Egg Sales and on Quality Deterioration

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Robert P. Bentz[1]

Introduction

The table egg industry in the United States supplies the consuming public with a product valued at nearly two billion dollars annually. The industry accounted for more than five percent of the cash farm income received by farmers in 1958. Total annual egg production has remained relatively constant, ranging over the last five years from a low of 168 million cases in 1957 to 173 million cases in 1959. Egg production for 1960 is estimated at 164 million cases, a decline of about five percent from 1959.

Louisiana's table egg industry accounted for 10 million dollars of cash farm income in 1958, the latest year for which complete data are available. Total cash farm income in Louisiana was approximately 362 million dollars in that year. Thus, the Louisiana egg industry accounted for only three percent of cash farm income, slightly below the national average. Nevertheless, eggs were the eighth most important agricultural commodity in the state in 1958, when ranked according to cash farm income. The importance of eggs has been slowly increasing in the last decade. As the population of the state increases, the importance of eggs to Louisiana agriculture also appears to be increasing.

The population of the United States increased about six percent from 1956 to 1960. During the same period egg production was relatively constant. Population forecasts indicate even greater growth for the future. Thus, while population has been increasing, per capita consumption of table eggs has declined (Table 1). This reflects a widespread change in consumer buying and eating habits over the years.

The Problem

One of the most important problems facing the egg industry is the decline in per capita egg consumption. A second problem is maintaining quality until the egg is purchased by consumers.

Egg producers are unable to do much about the price of eggs because of the nature of the market structure. Individual producers are able to sell all of their eggs at the going market price but are

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unable to cause increases in the market price of eggs by individually restricting their output.

TABLE 1.—Per Capita Consumption of Shell Eggs, United States, 1951 - 1960

Year	Total Eggs Consumed Per Capita[1]	Year	Total Eggs Consumed Per Capita[1]
1951	365	1956	343
1952	362	1957	331
1953	354	1958	323
1954	351	1959	313
1955	346	1960[2]	304

[1]Total excludes frozen and dried egg products.
[2]Total for 1960 is estimated from data for five months.
Source: Agricultural Marketing Service, *The Poultry and Egg Situation*, Washington, D.C.: United States Department of Agriculture.

Like other farmers, egg producers have been caught in a cost-price squeeze. To lower the retail price of eggs as a means of encouraging consumption would only result in reduced income to the farmer, because of the relatively inelastic demand for eggs. In other words, there would be a less than proportionate increase in net revenue resulting from a given reduction in price. In recent years, however, producers have increased the size of their operation (volume) in order to gain efficiency and reduce per unit costs. This has helped to some extent. But for this approach to have continued success, there must be a shift in the demand for eggs such that more eggs will be consumed at any given price.

With respect to maintaining quality, there have been great improvements in "bred-in" egg quality. Likewise, "quality retaining" practices have been widely adopted by handlers of eggs in the marketing channel. Still, like most other food products, eggs will decline in quality over time. A major problem in marketing eggs is to control the amount of this deterioration.

Objectives

The primary objective of this study was to determine if certain merchandising practices, for example, the use of certain carton combinations at various price differentials, would increase table egg sales and thus egg consumption. More specifically, the objectives were to (1) determine consumer preference for cellophane-overwrapped containers displayed with standard 2 x 6 cartons, (2) determine consumer preference for the clear plastic carton relative to the standard and overwrapped cartons when an added markup was charged for the plastic container and (3) determine the effect on total egg sales when clear plastic cartons were displayed with standard or overwrapped cartons and when the plastic carton was offered at various differentials.

A secondary objective was to determine the quality retaining characteristics of several packaging techniques. These techniques included the cellophane-overwrapped carton, mineral oil spray and a control or untreated lot for comparison purposes.

Procedure

Sales Response Test

The study of merchandising practices was conducted in the late spring of 1960 in Shreveport, Louisiana. Since sales promotion programs, special holidays and periods of unusual sales fluctuation should be avoided in an experiment of this kind, the sales response test was held during this period of relatively constant sales.

The cartons sold during the experiment were: (1) Standard 2 x 6 paperboard carton (*A*, Figure 1). (2) Standard 2 x 6 carton overwrapped with cellophane (*B*, Figure 1). (3) Plastic 2 x 6 carton clear on top with a blue styrene plastic bottom (*C*, Figure 1).

U. S. Grade A large white eggs were packed in all three cartons. Cartons (1) and (2) were alike in every respect with the exception of the cellophane overwrap. The clear plastic carton had the same brand identification as the standard and the overwrapped cartons but differed in that consumers were able to visually inspect the eggs before purchase.

It was not considered likely that any of the cartons would alone cause great increases in sales volume. Therefore, various combinations of the cartons were tested to determine which combination would result in increased sales.

Since the plastic carton is a more expensive carton to produce than the others, a price differential of four cents, approximating this difference, was selected as a base. This assumes that the main benefit of this carton, i.e., the clear top, is mainly for the consumer. Consequently, it should be paid for by the consumer and not be absorbed in the marketing margin. An even higher price differential of seven cents was also used to determine if consumers would react differently to the plastic container priced at a premium. The following five combinations of packages (dual displays) were used:

(1) Standard 2 x 6 carton and the same carton overwrapped with cellophane (no price differential).
(2) Standard 2 x 6 carton and clear plastic carton with an added four-cent markup.
(3) Standard 2 x 6 carton and clear plastic carton with an added seven-cent markup.
(4) Standard 2 x 6 carton overwrapped with cellophane and clear plastic carton with an added four-cent markup.
(5) Standard 2 x 6 carton overwrapped with cellophane and clear plastic carton with an added seven-cent markup.

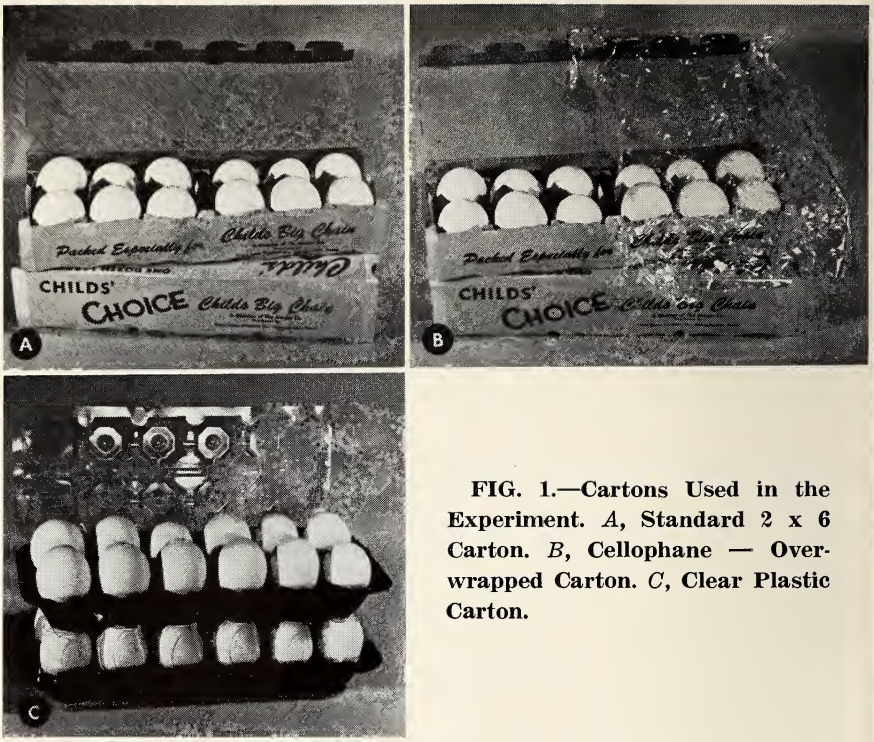

FIG. 1.—Cartons Used in the Experiment. *A*, **Standard 2 x 6 Carton.** *B*, **Cellophane — Overwrapped Carton.** *C*, **Clear Plastic Carton.**

The experiment ran for five weeks in five stores. The dual displays were placed in each store for a one-week period and then rotated to the next store. Thus, after five weeks each display had been in every store. Since most customers purchase groceries at least once a week, the response to a given combination of packages represents essentially the reaction of each store's usual clientele.

The five stores chosen were widely dispersed about the city of Shreveport. All were located in shopping centers having adequate parking facilities. Some were located in low income sections of the city and others in high income areas. Although no survey was taken to determine the exact characteristics of each store's clientele, the study included a wide range in types of customers.

The display cases were refrigerated in all five supermarkets. Four of the five stores had horizontal open-top cases, commonly referred to as dairy cases (Figure 2). The fifth store had a vertical enclosed display. Other food items, such as milk and butter, were displayed along with eggs in all five stores.

The size of the experimental displays was determined by the amount of space allotted to Grade A large eggs in each store. This space was divided *equally* between the two types of cartons to be

FIG. 2.—Example of a Typical Display Case in One of the Stores Used for the Experiment.

displayed. The position of the entire display remained unchanged for the duration of the experiment. Volume of eggs displayed in each store varied from 120 to 192 dozen per display at full capacity.

Conducting the Test—Regular invoice numbers were assigned to each experimental carton for purposes of ordering. Store personnel who normally ordered the eggs were supplied with lists showing which types of cartons were to be sold during each time period. The quantity to be ordered was left to the discretion of store personnel. When eggs in a given store were left over from a previous week and were packed in a carton not scheduled to be in that store the following week, arrangements were made to shift these eggs to another store.

Each store was visited three times daily by a research field worker. If either or both sides of the matched display were low, they were restocked. Between visits of the field worker, regular store employees stocked the egg displays when necessary.

The displays were allowed to naturally decrease in size and were not kept full all of the time. However, the decrease in size was allowed to occur only through a lessening of the height of the displays. The number of linear feet of display space facing customers was held constant throughout the experiment. Furthermore, the

height of the two parts of each display was continually adjusted to keep both sides approximately matched in appearance. The normal practice was to fill the display case to capacity on the first day of each time period. Thereafter, the display was restocked as necessary to maintain an attractive display, matched in appearance and having at least a little "built-in action."

Each time period was begun on a Tuesday morning and ended at the close of business the following Monday. Since it is a common practice in supermarkets to restock depleted displays during the earlier part of the week, this practice was also followed by the researcher. Every Tuesday morning an accurate count of all eggs in the display case and backroom storage was made. This inventory served as the ending inventory for one time period and the beginning inventory for the next.

To determine the number of dozens sold of each category of eggs, the ending inventory was subtracted from the beginning inventory with an adjustment for eggs delivered during the week. No adjustments in sales were made for cartons which contained broken eggs and which may not actually have been sold, since there was no accurate method to determine the number of dozens so rejected.

The matched-lot experimental design in marketing research is subject to a non-test variable called the "position effect." Customers are known to follow a somewhat consistent route through the various parts of most supermarkets. When there is more than one display of a given commodity, there is a strong tendency for customers to select the item to be purchased from the first display passed. To remove this position effect, the order of the displays was reversed twice each week.

Pricing of Eggs—It was important to allow prices to fluctuate in a normal fashion so that the stores in the experiment could remain competitive with stores not taking part. It was not the intent of the experimenters to attract customers who normally shopped elsewhere, and it is acknowledged that price is in itself a causal force in determining what consumers will buy. Prices, therefore, were set in accordance with the grocery chain's normal procedure, with the exception of the additional markup assigned to the clear plastic containers. Prices were the same in all five stores.

During the first week a price of 52 cents was charged for the Grade A large eggs in the experimental cartons. The second week, the price was 49 cents, and the third week it was lowered to 47 cents. The last two weeks of the experiment the price was 49 cents. The price adjustments made from week to week of only two to three cents probably did not greatly affect egg sales.

It should be remembered that in every comparison of sales from dual displays involving the plastic carton, the effect of price was in-

separable from the measurement of consumer preference. However, measuring the relative preferences for the cartons at equal prices would be of little value, since the plastic carton is more expensive to produce than the other and would not normally be sold at the same price.

Quality Deterioration Study

A logical adjunct to the merchandising experiment was the determination of the quality maintenance characteristics of the various cartons for which sales response had been determined. Consequently, a controlled experiment was used to determine the rate of decline in quality due to various packaging factors. The experiment was begun on July 8, 1960, and concluded on July 29, 1960.

Cold storage and mineral oil are used for maintaining egg quality for relatively long holding periods in the industry today. Most eggs, though, are not held in storage but are moved rapidly through the marketing channel to the consumer. Still, some decline in quality does occur in fresh eggs, and it is this decline with which we are concerned. The magnitude of decrease in quality is about two-thirds of a grade, or approximately 15 Haugh units.[2] This measure of quality decline was determined in previous experiments for eggs sold in retail outlets and fresh eggs laid under typical Louisiana temperature and humidity conditions.

It is a generally accepted fact that egg quality declines over time. Varying temperature and humidity conditions also greatly affect the amount of this deterioration in quality. An experiment was conducted to determine which of several factors were responsible for quality decline and which, if any, of several treatments slowed down quality loss. The factors included in the design of the experiment were two temperature conditions, three merchandising practices and four time periods. The design called for 864 individual measurements of egg quality.

Conducting the Test—The basic time period was a seven-day interval. A sample of 216 eggs was measured when the eggs were one day old and once each seven days thereafter for three weeks. The experiment was concluded at the end of three weeks because this closely approximates the maximum length of time that eggs are in the marketing channel.

Eggs were held under two temperature conditions—room temperature and refrigerated storage. Room temperature was maintained relatively constant at 73 degrees Fahrenheit with the aid of air conditioning. Under the second temperature condition, refrigerated

[2]Haugh unit: A measure of internal egg quality based on the height of thick albumen adjusted by the weight of the egg.

storage, temperature was held at approximately 45 degrees Fahrenheit. One-half of the sample, or 432 eggs, was held under each of the temperature conditions.

Three merchandising practices were also tested for their effect on egg quality as follows:

(1) Untreated eggs placed in standard 2 x 6 paperboard cartons.
(2) Untreated eggs in standard cartons overwrapped with cellophane.
(3) Eggs sprayed with a light neutral mineral oil and packed in standard cartons.

Eggs used for the experiment were collected from two of the cage houses at the Louisiana State University Poultry Farm in Baton Rouge. All birds had been fed a similar ration and had been uniformly handled throughout the year. The hens were all of a single commercial Leghorn strain and had been in production for approximately 10 months. All eggs were infertile.

Eggs with cracked shells, blood and meat spots and those below U.S. Grade A large were removed. The remaining eggs, a total of 72 dozen, all from one day's lay, were then placed in standard 2 x 6 cartons. Twenty-four of these dozens were packed in cartons and left untreated. A similar number were overwrapped with cellophane, and the remaining 24 dozen were treated with a light mineral oil.

FIG. 3—Illustration of the Egg Measurement Process.

Measurement of Egg Quality—Eggs were first weighed individually and then broken out onto a flat glass surface. The height of thick albumen was measured with a micrometer and recorded in milimeters, along with the egg's weight in ounces (Figure 3). These values were later converted to a single measurement termed Haugh units.

Analysis of Findings

Consumer Preference for Carton Type

Standard Versus Cellophane-Overwrapped Cartons—A preference was shown for the cellophane-overwrapped carton when compared to the standard carton. The preference, though, was not nearly so strong as was demonstrated in the comparisons yet to be discussed. In fact, in one store the standard carton was preferred over its overwrapped counterpart, and in another, sales were approximately equal. In the remaining three stores, the cellophane-wrapped carton was preferred over the standard container; in one instance, by as much as two to one (Table 2).

An analysis of the total egg sales for all stores together indicated that, in total, the cellophane-wrapped package was preferred over the standard.

Store III, the store in which the preference for the standard carton was indicated, was the one store which had a vertical glass-

TABLE 2.—Sale of Eggs in Standard Cartons Versus Cellophane-Overwrapped Cartons, Five Supermarkets, Shreveport, Louisiana, April 26, 1960, Through June 7, 1960

Store Number	Total Sales	Standard Sales	Cellophane Sales	Percent Standard Was of Total
		Number of Dozens		
I	1,185	489	696	41.2
II	903	444	459	49.2
III	933	524	409	56.3
IV	1,005	402	603	40.0
V	663	241	422	36.3
Total	4,689	2,100	2,589	44.8

enclosed display case. It is possible that the glass windows may have reduced the light reflecting quality of the cellophane wrapping. This might account for the lack of consumer response to the cellophane wrap in this store.

It would seem, nevertheless, that the manner in which eggs are displayed is not all that is involved. In certain stores there was a marked preference for cellophane-wrapped cartons. In others this

was not the case. Consequently, the problem of identifying the characteristics of stores and their customers which cause one carton to be preferred over the other should be seriously considered. The practice of overwrapping might be limited to the stores where it added most to consumer satisfaction. It should be noted that this comparison (standard versus cellophane-wrapped cartons) was the only one tested which did *not* involve a price differential. The preference shown can be considered to be entirely due to the type of container.

Standard Versus Plastic with an Added Four-Cent Markup—In the second matched-lot comparison (standard versus the plastic carton with an added four-cent markup) the preference for the standard carton was very definite. Only 11.8 percent of the total sales in the five stores were in plastic cartons (Table 3). The lack of preference for the plastic carton may have been due, however, to its premium price. It might also have been caused by the fact that this carton was relatively new in the supermarkets where it was tested (it had been on sale for only four months prior to the experiment). A third causal factor may have been the fragile appearance

TABLE 3.—Sale of Eggs in Standard Cartons Versus Plastic Cartons with an Added Four-Cent Markup on the Plastic Carton, Five Supermarkets, Shreveport, Louisiana, April 26, 1960, Through June 7, 1960

Store Number	Total Sales	Standard Sales	Plastic Sales	Percent Standard Was of Total
		Number of Dozens		
I	1,078	932	146	86.4
II	730	665	65	91.9
III	983	914	69	93.0
IV	880	739	141	84.0
V	628	544	84	86.6
Total	4,299	3,794	505	88.2

of the carton. No matter what the reason, standard cartons were definitely preferred by consumers over the clear plastic containers in this matched comparison.

Standard Versus Plastic with an Added Seven-Cent Markup—In all of the sales comparisons, preference for one carton over the other was assumed to exist when the ratio of sales deviated significantly from one to one. In the third comparison, that of standard versus plastic cartons with an added *seven*-cent markup, there was again no question concerning which was preferred. As would be ex-

pected, sales of eggs in plastic cartons were small, ranging from only 6.6 to 20.9 percent of the total for the five stores (Table 4). The over-all average of plastic carton sales was 11.4 percent of the total sales. This was essentially the same proportion sold when the price differential between cartons was only four cents.

Cellophane Versus Plastic with an Added Four-Cent Markup—A similar comparison was made using a cellophane-overwrapped carton and the clear plastic container. This fourth matched-lot again involved a *four*-cent price differential on the plastic carton. Sales of

TABLE 4.—Sale of Eggs in Standard Cartons Versus Plastic Cartons with an Added Seven-Cent Markup, Five Supermarkets, Shreveport, Louisiana, April 26, 1960, Through June 7, 1960

Store Number	Total Sales	Standard Sales	Plastic Sales	Percent Standard Was of Total
		Number of Dozens		
I	900	841	59	93.4
II	570	451	119	79.1
III	1,247	1,140	107	91.4
IV	1,369	1,201	168	87.7
V	515	442	73	85.8
Total	4,601	4,075	526	88.6

eggs in plastic cartons ranged from 10.2 to 21.8 percent of total egg sales among the various stores (Table 5). The weighted average was 12.7 percent, again not greatly different from the previously discussed comparisons.

TABLE 5.—Sale of Eggs in Cellophane-Overwrapped Cartons Versus Plastic Cartons with An Added Four-Cent Markup, Five Supermarkets, Shreveport, Louisiana, April 26, 1960, Through June 7, 1960

Store Number	Total Sales	Cellophane Sales	Plastic Sales	Percent Cellophane Was of Total
		Number of Dozens		
I	999	892	107	89.3
II	730	571	159	78.2
III	1,103	962	141	87.2
IV	1,310	1,175	135	89.7
V	751	674	77	89.7
Total	4,893	4,274	619	87.3

Cellophane Versus Plastic with an Added Seven-Cent Markup—In the fifth and last comparison, cellophane-wrapped cartons versus

plastic cartons with an added *seven*-cent markup, a strong preference for the overwrapped carton (at the lower price) was again displayed. The proportion of dozens sold in plastic containers ranged from 9.0 to 15.7 percent of total sales (Table 6). The weighted average was 10.6 percent, only slightly less than the proportion of plastic cartons sold when the price differential was four cents.

Thus, standard cartons and the same cartons wrapped in cellophane were preferred over the higher priced, clear plastic cartons in all stores and at both price differentials. It was noted that there

TABLE 6.—Sale of Eggs in Cellophane-Overwrapped Cartons Versus Plastic Cartons with An Added Seven-Cent Markup, Five Supermarkets, Shreveport, Louisiana, April 26, 1960, Through June 7, 1960

Store Number	Total Sales	Cellophane Sales	Plastic Sales	Percent Cellophane Was of Total
		Number of Dozens		
I	1,105	1,005	100	91.0
II	828	719	109	86.8
III	1,028	932	96	90.7
IV	1,170	986	184	84.3
V	960	908	52	94.6
Total	5,091	4,550	541	89.4

was essentially no difference in proportion of dozens sold in plastic cartons when the price differential was varied from four to seven cents above the standard carton. Furthermore, the cellophane-wrapped carton was preferred over its unwrapped counterpart at equal prices.

Consumer Acceptance of Egg Cartons

Although it is of more than passing interest to know what type egg cartons consumers prefer, of more importance to the egg industry is whether or not better merchandising will increase total sales. It has been shown that consumers prefer the standard or the cellophane-wrapped cartons over clear plastic cartons. However, it cannot be deduced from the findings discussed thus far that egg consumption would be increased if industry followed the preferences indicated and ceased to offer the plastic carton. In fact, were the plastic carton not used, it is quite possible that a drop in egg purchases would result. Some customers who had been buying the clear plastic carton might not shift to the standard but would go elsewhere for their eggs. The effect on volume of sales would depend on how strongly customers held to their preferences.

Are Total Sales Increased?—It is the purpose of this section of the report to bring to light whether or not egg consumption is in-

creased as the result of any of the various merchandising practices tested. Since sale of eggs is considered synonymous with egg consumption, an increase in sales for a given combination of merchandising practices would indicate that this combination increased egg consumption.

To ascertain which, if any, combinations of egg cartons increased egg consumption, the two parts of each matched display were combined and the average of total sales for the display computed (Table 7). Sales were also converted to a per-100-customer basis to remove any bias due to number of customers.

It is evident from these data that the combination which sold the *least* number of dozens was the standard and clear plastic cartons with the four-cent price differential. This display had an average sale of 859.8 dozen per week, which amounts to 35.8 cases per week, in each of the five stores. It is of particular interest in that this was the combination of egg cartons and price differentials which was in use in the grocery chain just prior to the start of the experiment. This display resulted in the sale of 10.6 dozen (all five stores) per 100 customers.

The display which had the *greatest* volume of sales was the cellophane-wrapped carton and the plastic carton with the added seven-cent markup. The average for this display was 1,018.2 dozen per store, or 42.4 cases a week. Sales per 100 customers were 13.2 dozen, an increase of 2.6 dozen over the display with the lowest volume of sales. This difference in sales response was found to be greater than would be expected by chance variation.

Actually, any of the displays which included the higher price differential or the cellophane overwrap resulted in a significantly increased volume of sales. Average weekly volume of sales for the combination of standard and plastic cartons with an added four-

TABLE 7.—Average Number of Dozens of Eggs Sold for Various Combinations of Carton Types, Five Supermarkets, Shreveport, Louisiana, April 26, 1960, Through June 7, 1960

Combined Displays	Average Weekly Sales	Sales per 100 Customers
	Dozens	
Standard & Plastic at 4¢	859.8	10.6
Standard & Plastic at 7¢	920.2	11.8
Standard & Cellophane	937.8	12.0
Cellophane & Plastic at 4¢	978.6	12.6
Cellophane & Plastic at 7¢	1,018.2	13.2
Weighted Average	942.9	12.0

cent markup was 859.8 compared to 963.7 dozen for the other four displays combined. Consequently, egg consumption was *increased* by the use of cellophane-wrapped and/or a higher price differential on the plastic carton when sold along with the familiar standard carton.

Product Differentiation

Essentially, what has been demonstrated is the effects of *product differentiation.* One of the goals of product differentiation is to encourage consumers to desire a given brand or kind of product rather than merely the product itself. Another goal is to increase sales by offering several items quite similar in nature but "differentiated." Differentiation is accomplished by the use of brand names, grading, advertising and even unique containers. Several alternatives are made available to consumers who can then choose the ones which offer the most "consumer" satisfaction.

Eggs are often differentiated in this way. In some instances, price differentials are involved which take advantage of the fact that different income groups have different tastes. The actual difference in quality and size of the eggs themselves is in some instances substantial. In others there may be less justification for the higher price of certain brands or different packaging. Nevertheless, if sales are increased by this product differentiation, it can be assumed that greater "consumer" satisfaction has been obtained, in addition to greater profit for the producer and those in the marketing channel.

Interior Egg Quality

Average quality of eggs broken-out at one day of age in the quality deterioration study was just slightly below U.S. Grade AA (Table 8). In light of the age of hens and the high humidity and temperature conditions in which the eggs were laid, this score was excellent.

TABLE 8.—Average Quality of Eggs by Temperature, Time Period and Treatment, Egg Quality Deterioration Experiment, Baton Rouge, Louisiana

Treatment by Temperature	One Day	One Week	Two Weeks	Three Weeks	Weighted Average
			Haugh Units[1]		
Room Temperature					
Standard Carton	77.1	52.9	39.9	20.4	47.6
Mineral Oil	77.0	64.8	64.3	51.6	64.4
Cellophane	77.5	60.5	50.8	28.6	54.4
Weighted Ave.	77.2	59.4	51.7	33.5	55.4
Refrigeration					
Standard Carton	78.8	74.9	73.5	73.1	75.1
Mineral Oil	78.3	78.4	71.6	73.4	75.4
Cellophane	78.0	77.2	70.7	64.8	72.7
Weighted Ave.	78.4	76.8	71.9	70.4	74.4
Over-all Weighted Average	77.8	68.1	61.8	52.0	63.7

[1]USDA Grade AA, 79 Haugh units and over; A, 55—78 Haugh units; B, 31—54 Haugh units; C, 30 Haugh units and below.

The fact that these day-old eggs were not AA in quality, however, emphasizes the virtual impossibility of marketing all eggs from the same flock as AA grade throughout the year in this section of the country. It means that only a given percentage of day-old eggs could and should be marketed as U.S. Grade AA.

Over the three-week period, average quality declined a total of 25.8 Haugh units, from 77.8 to 52.0 Haugh units, or from Grade A to Grade B. Eggs kept under refrigeration declined from 78.4 to 70.4 Haugh units, a drop of only 8 Haugh units, while eggs kept at room temperature declined 43.7 Haugh units in the same three-week period (from Grade A to Grade B).

For eggs kept under refrigeration, there was no difference in quality retention among the three groups (untreated, cellophane wrapped and mineral oil treated).

For eggs held at room temperature, those sprayed with mineral oil retained their quality better than either the untreated group or the eggs in cartons overwrapped with cellophane. There was essentially no difference in quality between the untreated group and the overwrapped eggs. Both of these samples declined from A to C grade in three weeks. Consequently, if eggs are to be held for any length of time at room temperature, the most effective way of maintaining their quality (of the methods tested) is with mineral oil. But if they are to be kept under refrigeration until consumed, it is difficult to justify oil treating or cellophane wrapping on the basis of quality retention.

Summary and Conclusions

Customers in three out of five stores showed a preference for cellophane-overwrapped egg cartons over standard cartons at equal prices. For all five stores combined, 55 percent of one week's sales were of cellophane-wrapped cartons, which indicates there was only a slight preference for cellophane-wrapped cartons.

The standard carton and the standard carton overwrapped were preferred over a clear plastic carton when the plastic carton was sold at a higher price of from four to seven cents. Only 12 per cent of weekly sales were in clear plastic cartons. Customers were either unwilling to pay the higher price or, in fact, did not prefer the plastic containers.

The dual display which resulted in the *greatest* sales volume was the cellophane-overwrapped carton and the clear plastic container with an added seven-cent markup. This display had sales amounting to 13.2 dozen per 100 customers.

The dual display which resulted in the *least* sales volume was the standard carton and the plastic carton with an added four-cent markup. This display resulted in sales of 10.6 dozen on a per-100-customer basis.

Total sales, and thus egg consumption, were increased by those display combinations involving cellophane-overwrapped cartons and plastic cartons at the two price differentials. Total sales were also increased over the usual volume by merely *increasing* the price differential on the plastic carton from four to seven cents in the displays with the familiar standard carton.

Egg quality decline was negligible (8.0 Haugh units) for eggs held at 45 degrees Fahrenheit for three weeks. Eggs kept at room temperature for the same length of time declined 43.7 Haugh units, or from Grade A to Grade B. Thus, the primary cause of quality decline in eggs was found to be high temperature.

Quality of eggs in cellophane-wrapped cartons kept at room temperature was not significantly different from that of untreated eggs in standard cartons kept under similar conditions. However, eggs treated with mineral oil were significantly higher in quality than either eggs in cellophane-wrapped cartons or standard cartons held at room temperature.